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THE PATENT OFFICE LONDON

(72) Inventor: JACK KENYON

(54) METHOD OF PRODUCING A COVERED ROLLER AND A ROLLER PRODUCED THEREBY

(71) We, THE MOSELEY RUBBER COMPANY LIMITED, a British Company of Mancunian Way, Manchester M12 6HL, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

The invention concerns covered rolls, and has more particular, though not exclusive, reference to a method for the manufacture of polymeric covered rolls for use in the steel-plate coating, papermaking and like industries, and also to a polymeric covered roll produced in accordance with such method.

In the production of large dimension polymeric covered rolls for the steel-plate coating, papermaking and like industries it is usual for such rolls to be custom made, as distinct from being made for and purchased from stock, in view of the variety and the inherent uniqueness of the individual rolls.

The covering may be applied to a metal core by wrapping a preformed material in sheet or tape-like form about such core, or by moulding a covering *in situ* onto the core, and it is to the latter method that the present invention primarily relates.

In providing an *in situ* moulded covering it is necessary, firstly, to prepare a suitable cylindrical mould, to locate the metallic core accurately axially of such mould, to introduce the material from which the covering is to be formed into the annular space between the interior of the mould and the roll core, and subsequently to effect the curing of the material.

The preparation of the mould, bearing in mind the fact that the mould will be of application only in connection with the production of the 'custom made' roll for which it was made, is an inordinately expensive operation, and since the cost of the mould will reflect on the cost of the end product, namely the covered roll, the covered roll will be correspondingly expensive if a limited number only of custom covered rolls to the specification to which the mould relates are required.

The object of the present invention is to provide an alternative to the *in situ* moulding method previously practised in producing a covered roll, or indeed a roll covering or sleeve, which avoids the need, and hence the expense, of preparing a mould.

According to the present invention there is proposed a method of producing a roller comprising a core and a covering thereto which comprises applying successive overlying coating thicknesses of a liquid or fluent polymeric coating material to and externally of the core during multiple rotations thereof to give an eventual covering of a requisite thickness, a respective coating thickness being applied at each successive rotation of the core and the successive thicknesses being coextensive in the direction of the rotational axis of the roll, and subjecting each respective coating thickness of the covering material to such temperature change as is appropriate to render the same coherent with the layers existing on the core prior to the application of the next succeeding layer. The roll core may, in effect, constitute a mandrel from which the covering is removed for subsequent application to another core as a covering thereto.

In one embodiment a method of forming a covered roll includes the steps of partially immersing a roll core in a supply of polymeric material provided in a trough with which the core is arranged in parallel disposition, rotating such core whilst so immersed, and progressively building up a covering of the polymeric material on the said core.

In a modification, an intermediate roller is partially immersed in the trough and transfers coating material therefrom to the

roller core, the core being arranged in nip contact with the intermediate roller and located at a position remote from the material in the trough.

Preferably the roll core will be rotated continuously, and the rotational speed will be that appropriate, having regard to the characteristics of the polymeric material and the environment conditions, to give a maximum rate of build-up of roll covering.

In another embodiment a roll core is provided with a covering by a method wherein covering material in fluent form is spread onto the surface of the core from above whilst rotating the core and building up multiple coatings of material on the core to a thickness appropriate to that of the covering thickness required.

Preferably, the material as applied by spreading will be applied at a controlled rate.

The invention will now be described further, by way of example only, with reference to the accompanying drawings illustrating several embodiments thereof in diagrammatic manner, and in which:-

Figure 1 is a side elevation of a first embodiment of the invention, wherein a roller core to which a covering is to be applied is partially immersed in a trough containing covering material in liquid form;

Figure 2 is a modified form of the embodiment shown in Figure 1, and differs therefrom by application of covering material to the core via an intermediate lick roller itself partially immersed in the material in the trough;

Figure 3 shows a further embodiment of the invention wherein the coating material is applied by means of a "damming" technique;

Figure 4 is a modification of the embodiment shown in Figure 3, wherein the blade shown therein is replaced by a roller;

Figure 5 shows a still further embodiment wherein the coating material is applied by means of a spraying technique; and

Figure 6 is a modification of the arrangement shown in Figure 5, the coating material being fed onto the surface of the core at a metered rate from a supply of such material.

Referring now to the drawings, and particularly to Figure 1 thereof, a covering 11 is applied to a roll core 12 by providing a supply 13 of a polymeric material in an elongate trough 14, partially immersing the roll core 12 in such material, and rotating such roll core whilst so immersed, thereby to allow of a build-up of material on the core. The rotation will be continuous and uniform, and will proceed until such time as the covering 11 is of a requisite thickness, the speed of rotation being determined by the time required to effect fusion of an applied layer of material with the core or with a previously applied layer before further contact with the material in the trough.

The material in the trough may be in liquid or powder form, and, in the latter case at least, the roller will be heated to effect adhesion of that powder in contact with the roller surface to such surface. As the rotation of the roller progresses, the powder on the roller surface will be heated to effect fusion thereof and on subsequent contact with the material in the trough will effect adhesion of the adjacent such material and apply a further coating thickness, which will, in turn, be fused. The process continues until a covering of an adequate thickness has been applied.

In the event that the material is in liquid form, such liquid will be subjected to a temperature change, that is to say heated or cooled according to the nature of the material involved, to render the material of a given coating thickness coherent with the coating layers existing on the core before application of a further coating layer by a subsequent core rotation.

In a modification of the procedure shown in Figure 1, instead of partially immersing the core in the material in the trough, the core is arranged in spaced disposition relative to the surface of the coating material and such material is carried to the core by means of a lick roller itself partially immersed in the material in the trough with which lick roller the core is in rolling contact. Thus, referring now to Figure 2, a lick roller 15 is partially immersed in coating material 13 provided in a trough 14, the core 12 to which a coating 12′ is to be applied being arranged in nip contact with such lick roller. The lick roller 15 is rotated in the direction of arrow A, and the core roller is generally rotated in the direction of arrow B, although counter rotation may be preferred with certain materials and in certain circumstances. The lick roller continuously transfers coating material from the trough to the surface of the core 12. The lick roller will be rotated at a speed, having regard to the diameter for the time being of the core 12 and coating 12′ thereon and the nature of the coating material as regards its fusion characteristics, such as will enable the last applied layer of coating material at a particular peripheral location effectively to be fused to the core or coating material present thereon before further immersion of that location in the coating material.

In a typical arrangement the lick roller has a diameter of approximately two inches and is driven at a surface speed of six inches per minute, the axis of the roller lying approximately in the plane of the surface of the coating material in the trough.

The coating material comprises a com-

mercially available pre-reacted polyurethane maintained at a temperature of approximately 70°C.

The roller core, which core may be of stainless steel, phosphor bronze or any other suitable material, has a diameter of twelve inches, the thickness of the intended covering being one inch, and such roller is pre-heated to a temperature in excess of 70°C, and preferably to a temperature in the range of 130°C to 160°C, and maintained at such temperature. The core is driven at a surface speed consistent with that of the lick roller, which surface speed is maintained constant and equal to that of the lick roller as the covering builds up.

The lick roller and trough are progressively lowered in relation to the axis of the core roller as the covering builds up thereon.

The coating present on the core is heated by such as infra-red heaters or electrical radiators to a temperature of between 130°C and 170°C to effect a sufficient level of gellation before application of further coating material, such heating, in the circumstances of the example, avoiding the need for subsequent heating of the covered roll.

In the circumstances of this example the covering builds up at the rate of approximately one eighth of an inch per hour.

Figures 3 and 4 illustrate alternative arrangements wherein the covering is produced by passing the coating material through a nip, the nip being defined by a blade bearing on the core (Figure 3) or by a pressure roll (Figure 4).

A further possibility is illustrated by Figures 5 and 6 wherein metered quantities of coating material, in powder or liquid form, are deposited on the roll, Figure 5 illustrating the use of a spray technique and Figure 6 the use of a metering device to supply material to the roll.

Any polymeric material is thought to be of application in the context of the invention, but the preferred materials are polyurethane, polypropylene, polyethylene, polyamide or liquid rubbers and rubbers in solution.

It is to be understood that after providing a covering by the methods aforesaid, the resultant product may be subjected to such after treatments as are appropriate including, for example, homogenisation, vulcanisation and machining.

In the case of the production of a covering which is subsequently to be removed from the core for application to another core as a sleeve thereto, the covering material will be such as not to bond to the material of the core, this being in contradistinction to those arrangements wherein the covering is to remain on the core and in which case there may be a positive bond between the material and the core.

WHAT WE CLAIM IS:-

1. A method of producing a roller comprising a core and a covering thereto which comprises applying successive overlying coating thicknesses of a liquid or fluent polymeric coating material to and externally of the core during multiple rotations thereof to give an eventual covering of a requisite thickness, a respective coating thickness being applied at each successive rotation of the core and the successive thicknesses being coextensive in the direction of the rotational axis of the roll, and subjecting each respective coating thickness of the covering material to such temperature change as is appropriate to render the same coherent with the layers existing on the core prior to the application of the next succeeding layer.

2. The method as claimed in claim 1, wherein the core is rotated continuously.

3. The method as claimed in claim 1 or 2, wherein the coating thickness is liquid and each successive coating thickness is subjected to such temperature change as is appropriate to effect at least partial gellation thereof.

4. The method as claimed in any one of the preceding claims, wherein the coating material is carried by an intermediate roller in nip contact with the core and from which the coating material is transferred to the core.

5. The method as claimed in claim 4, wherein the intermediate roller is partially immersed in a trough of coating material.

6. The method as claimed in claim 4 or 5, wherein the intermediate roller and the core roller are driven at constant and equal surface speeds.

7. The method as claimed in any one of claims 4 to 6, wherein the intermediate roller and trough are displaced radially of the core during build-up of the coating in step with such build-up.

8. The method as claimed in any one of the preceding claims, wherein the core roller is pre-heated.

9. The method as claimed in any one of the preceding claims, wherein the covering material comprises a pre-reacted polyurethane material.

10. The method of coating a roller core substantially as hereinbefore described with reference to and as illustrated in the various figures of the accompanying drawings.

11. A coated roller produced in accordance with the method claimed in any one of the preceding claims.

12. The method as claimed in any one of claims 1 to 9, wherein the covering material is separable from the core as a sleeve and which includes the further step of removing the covering material from the core.

13. A roller sleeve produced in accord-

ance with the method claimed in claim 12.

Agents for the Applicants,
SYDNEY E. M'CAW & CO.,
Chartered Patent Agents,
Saxone House,
52-56 Market Street,
Manchester M1 1PP.

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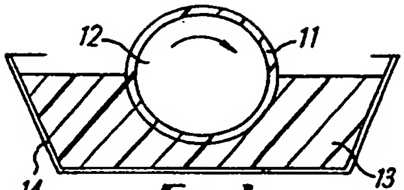

Fig. 1

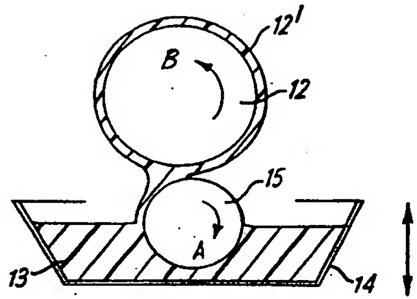

Fig. 2

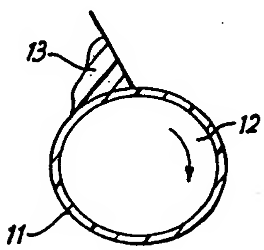

Fig. 3

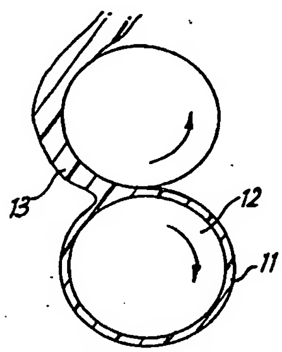

Fig. 4

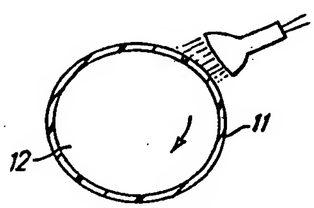

Fig. 5

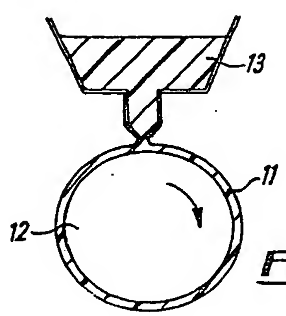

Fig. 6

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